Alberta
MUNICIPAL AFFAIRS

Innovative Housing Grants Program

DEVELOPMENT OF A NEW ROOFING MEMBRANE

Prepared by

Polymer Science Corporation

INTRODUCTION

This project assisted development and testing of a liquid-applied roof coating. The proponents had conceived a seemingly superior flat roofing product; however, the principal polymer in the formulation was expensive and imported. This project involved the identification of an alternate, readily available polymer that could be cost-effectively modified and substituted into the formulation without detriment to the performance characteristics of the membrane.

Critical features of the membrane that had to be retained were the requirements that it be:

- applied in the fluid state and therefore seamless;
- bondable to substrates like styrofoam, polyurethane foam, wood, concrete and modified asphalt;
- fast curing to form a water resistant elastomeric membrane;
- highly resistant to degradation by environmental stresses;
- non-toxic and environmentally acceptable (i.e., contain only small amounts of volatile organic compounds);
- sufficiently permeable to allow escape of moisture from within the substrate;
- sufficient in tensile strength and elongation to withstand the physical stresses caused by movement of the substrate over a temperature range of -40 to + 100 °C;
- easily repaired if damaged;
- practicable to produce in a relatively low-cost local manufacturing facility; and
- price competitive with EPDM (ethylene propylene diene monomer) roofing products.

APPROACH

Project work commenced in 1990. After an extensive review of existing scientific literature, several commercially available polymers were identified. Their properties were compared to the required physical targets and their manufacturing processes were evaluated. As a result of this process, acrylic co-polymers (latices) as aqueous dispersions were chosen for further technical examination.

Since completion of this project, the company has been producing and marketing liquid-applied roof coatings and cold patching compounds based on the membrane developed through this project. Product information can be obtained from Polymer Science Corporation, #2, 3411 - 10 Street S.E., Calgary, Alberta T2G 3E5.

Date: July 1992
ISBN: 0-88654-394-0

A number of such latices were then selected for chemical analysis and synthesis at a laboratory scale. Selections were based on technical information available from chemical manufacturers and were further narrowed through experience gained by formulating the roofing product from these latices.

Analyses primarily involved Fourier Transform Infra-Red Spectroscopy and Gas-Chromatography in conjunction with Mass Spectrometry. The information gained on the chemical composition of the selected polymers was incorporated into the synthetic program. Features of the synthesizing process that affect the properties and yield of the latices had to be optimized experimentally.

Promising batches of synthesized latices were then incorporated into a standard formulation of the roofing membrane and tested informally. Performance was judged by comparison to a standard generated from membranes produced using a commercial latex. The best performer was finally tested according to American Society for Testing and Materials (ASTM) standards selected by the Roof Coatings Manufacturers' Association (RCMA). Tests included:

- viscosity of the compound in liquid state;
- the effect of weathering on the tensile strength;
- elongation and recovery of the cured membrane;
- dirt pickup of the membrane before and after weathering;
- Shore hardness (hardness determined by dropping a diamond-tipped hammer from a fixed height and measuring rebound);
- adhesion;
- water vapour transmission; and
- swelling rate.

Testing was conducted by the Alberta Research Council, HBT Agra Ltd. and DSET Laboratories.

RESULTS

The final product, incorporating the synthesized latex, exceeded all RCMA standards except that for Shore hardness. Performance was only marginally below the standard in that respect. The latex synthesizing process was found to be sufficiently simple and safe for conversion to mass production. The conversion rate (raw material into finished polymer) was high and resulted in only minimal amounts of by-products. The process met the company's criteria for manufacturing. The scope of the research did not include final debugging and commercialization.